tearing and roaring, and wondering what would be the outcome. The gale brought storms of rain, not ordinary rain, but sweeping storms of water like spray, traveling too swiftly to fall downward. Soon roofs of houses began to tear away, and water was swept in. Some roofs were torn off entirely, and people had to leave everything, stumbling pitifully through the wreckage for shelter elsewhere. Few trees could withstand this tremendous force, and down they came. Worst of all was the turmoil in the harbor. No anchorage was safe for ships on such a night. Bigger vessels kept on full speed ahead, and perilously rode the storm; others dragged their anchors and ere seen drifting down the harbor and away to sea; some, it could be discerned, with people on board gesticulating in terror, but few could attempt to aid them. A true estimate can not yet be made, but it is said that over 40 vessels went helplessly adrift in this way. Men swam ashore in a desperate attempt when they felt their ships giving way. The sea boiled and raged, the harbor was no refuge. The tide swept over Bay Street, carrying boats with it, and plowing up everything in its way. When light came the storm was raging at its height and though everyone welcomed the end of that fearful night, it was seen that the worst was not yet over. The coming of dawn revealed a town lashed unceasingly by a pitiless wind intent on demolishing everything in its track, and driving rain as fine as smoke. The hurricane was now approaching its height, and large trees of every description which had withstood the battering of a night went down like ninepins before the awful crescendo which raged during the early morning. The waterlogged branches of many trees were their ruin, the shallow roots of palms proved a cause of their speedy destruction; but then, what could be expected to stand when concrete telegraph poles with iron cores were bent and broken off by the dozen? * * * Trees, telegraph wires, corrugated iron, shutters, and debris of every description lay sprinkled in the roadway; in fact, much of the debris was moving about on the ground, for the gale did not deign to leave alone what it had so scornfully torn down. For a quarter of a mile East Bay Street below Murphy's warehouse was a foot deep in water lashed by the hurricane into waves larger than those normally seen in the harbor itself. At the Eastern Parade, Bay Street was totally blocked by trees, and the field was a vast lake. Shirley Street was as impassable as if the bush had been given a hundred years to sprout through the asphalt, while the harbor was a milk-white inferno of turbulent water, running westward with the speed of a millrace. * * * Roofs were being stripped of their shingles as one peels the skin from an orange; the shuttered houses streaming with water gave no sign of the anxious life within, and save for a few hardy wayfarers Nassau seemed a town of the dead.

THE AFTERMATH

Yesterday came calm and sunny, and everyone was out early to see what damage had been done. Nowhere was the force of the storm better illustated than at Fort Montagu. What had been trim lawns and shrubberies and neat paths is now as ravaged as if it had been the scene of modern warfare, with tanks in action. The ground is all torn up; trees are uprooted; there are ruts and sand drifts and the scene is desolate. The Fort Montagu Hotel stands in a lake. A little further east it is even worse with the road itself torn up, littered with trees, and boats cast ashore. The western end of the island is the same. Fox Hill suffered terribly, many of the small dwellings having fallen like playing cards. In Grant's Town there is great distress. The scene has entirely changed, there are so many houses down and trees thrown across the roads, while to add to the hardship there are floods in the streets. A great many people are homeless. Other of the poor people are mourning the loss of their boats, their sole means of livelihood, while others are in fear for safety of their relatives out in sponging vessels or at sea on trips to the out islands. All over the island there is distress and loss, beside which the destruction of many of our beautiful vistas is a small matter. * * * Some of the finest trees in the city have been lost and among them, sad to say, the two tall Caicos palms in the Deanery garden which 50 years ago were reputed to be the oldest palms in the island. * * * The *Firebird* had her engines giving full speed ahead for four hours, and lost two shackles while the hurricane was at its height. One of her officers who has seen typhoons in the China Sea and has also had experience in West Indian hurricanes, said he has seen nothing to equal this. * * * A conglomeration of 65 boats, mostly pleasure craft, is to be seen on the beach near Mathew Avenue. Of 49 boats in the back channel, 42 are said to have been blown out of the harbor. * * * We have heard of many courageous acts performed during the storm, but one of the most outstanding was that of Captain Richardson, of the dredger *Lucayan*. He, it is said, saved over a dozen lives. People who were being swept past on sloops clung to the forestructure of the dredger, and the captain rushed to save them as they came, unheedful of the peril to himself.

* * * A great many automobiles were damaged, the covers being shred to ribbons and the enamel "burnt" off by the velocity of the wind; exposed paint work generally seemed to have undergone the fire of blow lamps. * * * It is generally agreed that the best roofing to resist hurricane onslaughts is that of cypress and cedar shingles, though few houses remained entirely dry throughout the storm. In some houses umbrellas were used when going from one room to another.

551.466.66

NOTES, ABSTRACTS, AND REVIEWS

THE APPLICATION OF CHRYSTAL'S THEORY OF SEICHES TO LAKE VETTER

The mathematical hydrodynamical theory of seiches—the free oscillations of lakes resulting from some disturbance of the equilibrium of the lake surface—was worked out by Chrystal (*1*). F. Bergsten, "The seiches of Lake Vetter," Geograf. Ann., 8, 1–73, 1926, has now applied Chrystal's theory to the calculation of the seiches on Lake Vetter in Sweden.

The longitudinal seiches are treated by drawing, on a bathymetric chart of the lake, a longitudinal axis; at a number of points along this axis, transverse cross sections of the lake are taken, spaced according to the rapidity with which the configuration of the bottom is changing; the area of each cross section is multiplied by the breadth of the lake at that point, and these products are plotted as ordinates against, as abscissae, the area of the portion of the lake surface between the origin (at one end of the lake) and the corresponding cross section. The resulting curve, called the "normal curve" of the lake, is then fitted (in sections) by a combination of straight lines, parabolas, and quartic curves.

The hydrodynamical equations of motion can now be integrated; and from the solutions the exact periods of the uninodal and various plurinodal longitudinal seiches, together with the positions of the nodal and ventral lines and the relations connecting the simultaneous heights of the water at different stations can be calculated.

An analogous treatment can be given transversal seiches.

The theoretically computed results show good agreement with the limnometer observations.

Forel and Chrystal found that for Lake Léman and Loch Earn the effect of winds in generating seiches was of secondary importance, whereas fluctuations in the barometric pressure over these lakes often resulted in large seiches. On the other hand, Bergsten finds that in the case of Lake Vetter the wind is the all-important factor; he points out that Lake Vetter, in comparison with its great area, is very shallow, and that in such a shallow lake the wind effect is the most important, whereas in a deep lake the wind effect would not ordinarily be of much importance. The effect of the wind in piling up the water in Lake Vetter is calculated by Hayford's method, and the potential energy thus stored up is shown to be adequate to account for the seiches often observed to follow such a piling up when the wind dies down or changes direction. Only very rarely is it possible to discover any connection between seiches on Lake Vetter and microbarographic records. It is found, by the method due to Hayford, that Lake Vetter would react to pressure changes in a practically static manner.

Bergsten concludes that there seems to be no doubt that the energy necessary for the generation of the seiches of the greatest magnitude on Lake Vetter is produced as a rule by the tangential traction of the wind against the lake surface; standing waves of great amplitudes may directly arise from the steady state by a sudden change in the wind, either abatement or turning through an angle of about 90°; also, with a still greater change of angle, under otherwise similar conditions, the amplitude would be much greater, and the origin of the most important seiches ever observed may be explained in this way. Continuous changes of the relative atmospheric pressure between the two ends of the lake may also be the origin of seiches, but with small amplitudes as a rule; the microbarographic disturbances are of still less importance.—*E. W. Woolard.*

LITERATURE CITED

CHRYSTAL, G.
1905. ON THE HYDRODYNAMICAL THEORY OF SEICHES. Trans. Roy. Soc. Edin., vol. 41, pt. III, pp. 599–649. (Includes historical sketch and bibliography of seiches.)

SIMPSON ON THE VELOCITY EQUIVALENTS OF THE BEAUFORT SCALE[1]

551.55

The question of suitable velocity equivalents for the Beaufort scale has been pressing for solution many years. Two solutions have been proposed and fully considered, one by the Deutsche Seewarte,[2] the other by the British Meteorological Office.[3]

Dr. C. G. Simpson after presenting a thorough analysis of both proposals submits a table of equivalents as shown in Table VI below and concludes with the recommendation printed in the closing paragraph below.

TABLE VI.—*Proposed code scale for wind velocity*

Code No.	Limits of velocity		Code No.	Limits of velocity	
	Meters per second	Miles per hour		Meters per second	Miles per hour
0	0–0.5	0– 1	6	9.9–12.4	22–27
1	0.6–1.7	2– 3	7	12.5–15.2	28–33
2	1.8–3.3	4– 7	8	15.3–18.2	34–40
3	3.4–5.2	8–11	9	18.3–21.5	41–48
4	5.3–7.4	12–16	10	21.6–25.1	49–56
5	7.5–9.8	17–21	11	25.2–29.0	57–65

CONCLUSIONS AND RECOMMENDATIONS

(*a*) There is no unique relationship between wind velocity as recorded by anemometers and estimates made on the Beaufort scale.

(*b*) Wind velocities measured by anemometers can be converted into Beaufort numbers only if the equivalent velocities appropriate to the exposure of the anemometer have been previously determined. The Seewarte has determined a satisfactory set of equivalents for anemometers having one type of exposure and the meteorological office another set of equivalents for anemometers with a much freer exposure.

(*c*) It is recommended that when wind velocity is measured by an anemometer the velocity should be reported in weather telegrams by the code set out as Table VI. If this code is used no difficulty will be experienced when the code numbers are plotted on synoptic charts along with Beaufort numbers.—A. J. H.

[1] Air Ministry, Meteorological Office, Professional Notes No. 14.
[2] Koppen: *Aus d. Arch Seewarte*, Hamburg, vol. 21, 1898, No. 5.
[3] Simpson: London, Meteorological Office, Publication No. 180, 1906.

A WISCONSIN TORNADO[1]

W. P. STUART

A tornado first seen in Bayfield County, Wis., within a few miles of Lake Superior at 6.15 p. m. July 16, moved thence in a southeasterly direction and was last seen near Clear Lake, Vilas County, Wis. The length of its path was about 85 miles and its width varied from 300 to 1,760 feet and in places the width of the path of damage was said to have been 6 miles. This extraordinary width seems to have been the width of the path of damaging winds, which may have been straight winds, as they were at Port Wing near the origin of the storm. A funnel cloud was observed at a number of places along the storm's path. Details as to loss of life and property will be found in the table on page 311, this REVIEW.

[1] Condensed from the author's report.—*Editor.*

The tornado passed through the center of the experiment farm at Ashland Junction and was observed by Prof. A. J. Delwiche, of the University of Wisconsin, to whom we are indebted for the following account:

Storm clouds appeared in the west-northwest at 6 or 6.30 p. m. The storm appeared as though it would pass over territory north of here, when in the northwest more clouds collected. Balloon like clouds appeared above, giving the surface a rolling appearance, our first evidence for a possible wind storm. A black layer below moved toward us. Above it the very narrow funnel cloud appeared, a narrow white streak in the black clouds. It was high and had not touched the ground as yet. It was several miles away. The black clouds rolled overhead, then they appeared to move northward, then again south to southwest. The wind began to blow, carrying dust and sand with it. The air was black with dirt and dust. The funnel could be seen coming nearer and nearer in the north-northwest, probably due to the position at which it was viewed, because the path of the funnel passed in a southwest direction.

As the funnel passed its nearest to us the side winds carried everything in its way; the buildings shook from the side winds. Trees were broken in an eastward direction to the north of us, and in a southward direction to the west of us. In the tornado path, 5 miles from here to the northwest, the first destruction took place. The first farmer lost all barn buildings without injury to horses. House was destroyed, tall pine and maple trees were uprooted, broken and twisted about. Next farms, the buildings were taken completely; a timber strip was broken off at heights above the ground of 10 to 20 feet. Farm buildings were wiped out completely as the storm proceeded onward and passed through this section (Ashland Junction), tearing up telephone and telegraph wires, and blocking highways. Then onward to the southwest where two girls were killed, and other homes destroyed for a distance of 5 miles from here. Then the storm did not tear up as many buildings. This is as the storm appeared to us here at the experiment station, and the destruction of the near-by area.

551.578.1

HEAVY RAINS IN VARIOUS PARTS OF THE WORLD

Press reports throughout July carried many references to torrential rains and destructive floods in sundry parts of the world. At best these reports are based on somewhat meager information and deal with the spectacular rather than the scientific aspect of the natural phenomena involved.

NORTH AMERICA

Flood-producing rains fell during the early part of the month in the Mexican States of Sonora, Sinaola, and Nayarit; as a consequence the vegetable crop for export to the United States was cut in half at a loss estimated at $7,500,000.

In the Valley of Mexico extending from about 200 miles north of Mexico City south to the Isthmus of Tehuantepec torrential rains fell almost daily during the early part of the month, causing much damage and suffering. On July 6 it was said:

The greater part of the lowlands of the Valley of Mexico are flooded—something that has not happened in a quarter of a century. From the heights above the town of Tacabaya, south of the capital, the whole Valley of Mexico east to the mountains appears to be a great inland lake. Apparently there has been complete destruction of crops throughout the Mexican Plateau and the loss is estimated at from 10,000,000, to 15,000,000 pesos.

The above is in addition to the loss first enumerated.